Final Investigation Report
on
Serious Incident of Airprox
between
A320-251N aircraft VT-EXQ of M/s Air India Ltd
and
King Air 65-C90B aircraft VT-NKF of M/s Pinnacle Air Pvt. Ltd.
on 5 October 2021 in Mumbai FIR

GOVERNMENT OF INDIA
MINISTRY OF CIVIL AVIATION
AIRCRAFT ACCIDENT INVESTIGATION BUREAU

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Date & Time of Incident	5 October 2021 & 1119 UTC	
Place of Incident	Approx. 40 NM North East of Mumbai Airport	
ATS Unit	Area Control Centre, Mumbai	
Type of Incident	Airprox	
Classification of airspace	Class D	
Applicable ATC separation	Surveillance based horizontal separation of 5 NM and vertical separation of 1000 feet	
Recorded Minimum separation	Approx. 1 NM horizontal (lateral) and 400 feet vertical	
Light conditions	Daylight	
	Aircraft 1	**Aircraft 2**
Type of aircraft	A320-251N ICAO Type Designator A20N	King Air 65-C90B ICAO Type Designator BE9L
Wake turbulence category	Medium	Light
Nationality	Indian	Indian
Registration	VT-EXQ	VT-NKF
Call-sign of the aircraft	AIC732	VTNKF
Flight Planned Route	VEPT-W44-BBN-W33N-KKJ-G590-BPL-W146-AAU-G450-OPAKA-VABB	VABB-G450-TEGIG-V38-VERP
Operator	M/s Air India Limited	M/s Pinnacle Air Pvt. Ltd.
ACAS capability	ACAS II (TCAS II) Change 7.1	Not equipped with TCAS
Surveillance Equipment and capabilities	SSR Mode S and ADS-B with dedicated 1090 MHz with ADS-B "out" capability	SSR Mode C
Type of flight	Scheduled air services	Non-scheduled air transport operations
Last point of Departure and ATD	Patna Airport, India 0931	Mumbai Airport, India 1057
Point of intended landing and ATA	Mumbai Airport, India 1146	Raipur Airport, India 1329
Flight Rule	IFR	IFR
Crew on Board	Flight Crew 2 + Cabin Crew 4	Flight Crew 2 + Cabin Crew 0
Passengers on Board	138	4
Injury	None	None

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Foreword

In accordance with Annex 13 to the Convention on International Civil Aviation Organization (ICAO) and Rule 3 of Aircraft (Investigation of Accidents and Incidents), Rules 2017, the sole objective of the investigation of an accident or incident is to prevent accidents and incidents and not to apportion blame or liability.

Therefore, this report is not for the purpose to determine blame or clarify questions of liability. If this report is used for purposes other than incident and accident prevention, this may give rise to erroneous interpretations.

The report has been prepared based upon the evidence collected during the investigation and opinion obtained from the experts.

Unless otherwise indicated, all times in this report are stated in Co-ordinated Universal Time (UTC). The relationship between IST and UTC is: IST = UTC + 5½ hours.

For reasons of data protection and simplification of the text, this report uses exclusively the generic masculine.

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Glossary

AAIB	Aircraft Accident Investigation Bureau, India
AAI	Airports Authority of India
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
ACC (N)	Area Control Centre (North)
ADS-B	Automatic Dependent Surveillance–Broadcast
AI	Air India
AIP	Aeronautical Information Publication
ANSP	Air Navigation Service Provider
Approx	Approximately
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATD	Actual Time of Departure
ATIS	Automatic Terminal Information Service
ATPL	Airline Transport Pilot Licence
CAR	Civil Aviation Requirement
CB	Cumulonimbus
CCW	Current Conflict Warning
CFL	Cleared Flight Level
CPL	Commercial Pilot License
CSOP	Company Standard Operating Procedures
CVR	Cockpit Voice Recorder
DGCA	Director General of Civil Aviation
DFDR	Digital Flight Data Recorder
DAP	Downlink Aircraft Parameters
ETA	Expected Time of Arrival
ETD	Expected Time of Departure
FCU	Flight Control Unit
FL	Flight Level
FO	First Officer
ICAO	International Civil Aviation Organization
IATA	International Air Transport Association

IFR	Instrument Flight Rules
IIC	Investigation-in-Charge
IST	Indian Standard Time
Ltd.	Limited
MATS	Manual of Air Traffic Services
MHz	Mega Hertz
min	Minute(s)
NM	Nautical Mile
NOTAM	Notice to Airmen
PCW	Predicted Conflict Warning
PIC	Pilot In Command
PF	Pilot Flying
RNAV	Area Navigation
PM	Pilot Monitoring
PIC	Pilot In Command
Pvt.	Private
RA	Resolution Advisory
R/T	Radio Telephony
SA	Selected Altitude
SOP	Standard Operating Procedures
SSR	Secondary Surveillance Radar
STAR	Standard Terminal Arrival Route
STCA	Short-Term Conflict Alert
STL	Supervised Take-off and Landing
TCAS	Traffic Alert and Collision Avoidance System
TOD	Top of Descent
VHF	Very High Frequency
VCCS	Voice Communication Control System
VOR	VHF Omni-directional Range
UTC	Co-ordinated Universal Time

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Synopsis

On 5 October 2021, AIC732, A320-251N, registration VT-EXQ, operator M/s Air India Ltd., a scheduled flight from Patna to Mumbai and VT-NKF, aircraft type King Air C90B, operator M/s Pinnacle Air Pvt. Ltd. were flying under the control of Lower Area Control, Mumbai. AIC732 was descending to FL180 and VT-NKF was maintaining FL170 as per the ATC clearances. These aircraft were encountering adverse weather conditions and deviating from flight planned routes.

The incident took place when First Officer (Pilot Flying) of AIC732 accepted ATC descent clearance to FL150 intended for other aircraft and started descent to FL150 from FL180. This resulted into conflict with opposite direction traffic VT-NKF. A TCAS RA was generated which was promptly responded by the flight crew members of AIC732. The intruder aircraft VT-NKF was not equipped with TCAS. However, VT-NKF was equipped with transponder Mode C.

When AIC732 commenced descent from FL180 and passed predefined limit of level for generation of Short-Term Conflict Alert (STCA), a conflict warning was generated on the air traffic controller's situation display. The controller promptly reacted to the situation and issued conflict resolution instructions but flight crew members of AIC732 were busy in dealing the TCAS RA event. Both the aircraft passed each other with lateral separation of about 1 NM and vertical separation of 400 feet. There were no reports of injury to the passengers or crew, or damage to the aircraft.

The lateral and vertical separations between these two aircraft reduced below the safe limits and hence was the air-proximity incident.

Director General, Aircraft Accident Investigation Bureau appointed Investigator-in-Charge vide order number INV 12011/4/2021-AAIB dated 13 October, 2021, to investigate into said serious incident to find out the probable cause(s) of the Serious Incident under Rule 11 (1) of Aircraft (Investigation of Accidents and Incidents), Rules 2017. The investigation was based on the recordings of the radio communications of ATS system recorder, ATS surveillance (radar) recordings, CVR & DFDR recordings of AIC732, the information provided by the aircraft operators concerned and the Air Navigation Service Provider, the statements and interview of the air traffic controller and the flight crew members of AIC732 and VT-NKF.

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1. Factual Information:

1.1 History of the flight

Aircraft 1:

On 5 October 2021, AIC732, Registration VT-EXQ, an IFR flight, type A320-251N, a scheduled passenger flight operated by M/s Air India Ltd., departed from Patna at time 0931 UTC for Mumbai. There were two flight crew members on board. PIC was PM and FO was PF. Prior to the incident on the 4th sector from Patna to Mumbai, same set of flight crew operated previous three sectors (Mumbai-Patna as AIC673, Patna-Kolkata as AIC673 and Kolkata-Patna as AIC732) on the same day which were uneventful. Both PIC (P1) and FO (P2) of flight VT-EXQ (AIC673) reported for flight duty at Mumbai prior to their reporting time starting at 01:25 UTC (06:55 IST). The AIC732 landed at Mumbai at time 11:46 UTC. Duty of flight crew members ended at time 12:26 UTC. In the past, PIC and FO had never operated the flight pattern (Mumbai-Patna-Kolkata-Patna-Mumbai) i.e., landing twice on the same day at the critical airport Patna (an airport having performance limiting conditions).

Aircraft 2:

On 5 October 2021, VT- NKF, type C90B (a twin-engine turboprop fixed wing aircraft), a non-scheduled IFR flight operated by M/s Pinnacle Air Pvt. Ltd. departed from Mumbai at time 10:57 UTC and was at level flight FL170, enroute to destination Raipur. There were two flight crew members on board. The PIC had the role of PF whereas co-pilot was PM.

Air Traffic Control (ATC):

On 5 October 2021, the air traffic controller at ATS Mumbai reported for afternoon shift. The afternoon shift started at 08:00 UTC (13:30 IST) and ended at 14:00 UTC (19:30 IST) as per pre-notified duty roster of air traffic controllers. He provided area control surveillance services as an ACC (N) controller from 08:00 UTC to 09:00 UTC and subsequently had a break (rest) of 2 hours from 09:00 UTC to 11:00 UTC. He again took over watch at time 11:00 UTC at LAC position for providing area control surveillance services. The incident took place at time 11:19 UTC when both the aircraft AIC732 and VT-NKF were being provided area control surveillance services by the LAC controller. The LAC was a sector of Mumbai Area Control having following jurisdiction:

- FL 145 / FL 245 (up to 50 NM around Mumbai VOR)
- FL 070 / FL 245(from 50 NM from Mumbai VOR to 100 NM around Mumbai VOR).

Sequence of the events

The flight crew members of VT-EXQ (AIC673/AIC732) and VT-NKF reported for duty as per their organisational policy. The flight crew of VT-EXQ reported for duty at 01:25 UTC (06:55 IST) for departure from Mumbai.

09:31	AIC732, VT-EXQ departed from Patna for Mumbai.
11:03:30	Mumbai Area Control (N) Surveillance controller identified AIC732 and cleared via EMRAK2A ARRIVAL for runway 27 and asked to report for descent. The aircraft was maintaining FL340.

As per CVR of AIC732, there were many non-flight-related conversations between flight crew before requesting for descent from TOD at 11:06:25 UTC.

11:06:25 AIC732 called Mumbai Control-ACC (N) and requested to descend from FL340 (Top of Descent).

11:06:29 ACC (N) cleared AIC732 to descend to FL250.

After commencement of descent from TOD, again there were many non-flight-related conversations between flight crew members of AIC732 before release to LAC at 11:09:09.

11:09:09 ACC (N) controller advised AIC732 to contact RADAR 133.425 (LAC)

11:09:31 LAC instructed to AIC732 to descend to FL 160 when AIC732 came in contact with LAC.

11:09:43 LAC transmitted "SEJ6636 MUMBAI DESCEND TO FL200." As per ATC transcripts and CVR transcripts of AIC732.

11:09:46 SEJ6636 readback as "DESCEND FLIGHT LEVEL TWO HUNDRED SPICE JET SIX SIX THREE SIX" as per CVR transcripts of AIC732 but this readback was not received at LAC position where the controller was providing the area control surveillance services (as per ATC transcripts).

11:11:52 VTNKF came in contact with LAC. The aircraft being non-RNAV aircraft had departed from Mumbai at 1057 for Raipur and was being radar vectored for waypoint SEKVI.

11:12:15 ATC instructed VTNKF to climb to FL170 due to traffic.

11:12:44 AIC732 requested right heading 260 due to weather which was approved by the controller.

11:13:34 The controller cleared VTNKF to point SEKVI but aircraft reported that it would proceed to SEKVI after 10 miles due to weather.

11:15:06 AIC732 was instructed by the controller to stop descent at FL180 due to deviating traffic which was acknowledged by AIC732. At this time as per DFDR, the aircraft was passing altitude 19984 and FCU selected altitude was 16000.

11:15:16 The flight crew selected altitude 18000 (the ATC cleared level) on FCU and was passing an altitude of 19740.

11:09:31 to 11:15:38 there were many non-flight-related intense conversations between flight crew members of AIC732. They also made some conversations about adverse weather.

11:15:38 FO(PF) started Approach Briefing

11:17:14 AIC 644 transmitted "MUMBAI RADAR AIR INDIA 644 NAMASKAR, MAINTAINING LEVEL 250 NOW". Approach Briefing by PF of AIC 732 continues.

11:17:18 to 11:17:30: Approach Briefing by FO (PF) of AIC732 was in progress during this period.

LAC transmitted "AIR INDIA SIX FOUR FOUR, NAMASKAR, DESCEND TO FLIGHT LEVEL ONE FIVE ZERO, AIR INDIA SIX FOUR FOUR". This message was recorded in ATC Tape and CVR of AIC732. Immediately after about

one second, AIC 644 started reading back "DESCEND FLIGHT LEVEL ONE FIVE ZERO AIR INDIA SIX FOUR FOUR" as per CVR of AIC732 but this message was not being received by the LAC controller as per ATC transcripts. When readback by AIC644 was in progress (as received in cockpit of AIC732) which was not being received by LAC, the LAC controller again repeated the instruction "AIC644 DESCEND TO LEVEL ONE FIVE ZERO". The resultant CVR recording was as appended below:

"DESCEND FLIGHT LEVEL ONE FIVE ZERO AIR INDIA SIX FOUR FOUR" in the voice of flight crew member of AIC644, followed by a garbled message for about one second, followed by FLIGHT LEVEL ONE FIVE ZERO in the controller's voice.

AIC732 FCU selected altitude was changed from 18000 ft to 15000

11:17:30 to 11:17:59 The LAC confirmed whether AIC732 was able to take a left turn for descend due to traffic at 12 o'clock to which the aircraft negated due to weather and accepted right heading 270.

11:18:45 CFL (Cleared Flight Level) Non-Conformance Warning was generated at the controller's situation display. Almost at same time TCAS Advisory "TRAFFIC TRAFFIC" was generated in the cockpit of AIC732. The PIC who was earlier PM, took over the control from FO.

11:18:49 A Predicted Conflict Warning (PCW) between AIC732 and VTNKF was generated at the controller's situation display.

11:18:57 The controller instructed AIC732 to turn right heading 360 immediately which was acknowledged by the AIC732. At this time, as per DFDR readouts, the aircraft was at altitude of 17480 and FCU selected altitude was 15000.

11:18:58 TCAS RA "LEVEL OFF LEVEL OFF" was generated which was promptly responded by the flight crew of AIC 732.

11:19:06 The controller instructed AIC732 to turn right heading 360, traffic 12 o'clock Level 170 which was not acknowledged.

Predicted Conflict Warning (PCW) converted into Current Conflict Warning (CCW) at the controller's situation display.

As per DFDR, TCAS RA was off. A cockpit annunciation CLEAR OF CONFLICT was generated

11:19:12 The controller called AIC732 but FO informed to standby as they had TCAS RA.

11:19:19 The controller called VKF and passed traffic 12 o'clock Air India Airbus 320 passing level 174

11:19:26 VTNKF acknowledged and reported crossed the traffic visually.

11:19:38: AIC732 reported FL174, clear of conflict, turning right heading 360. It was the voice of PIC. The speech was normal, well composed and full of confidence.

Subsequently AIC732 and VTNFK were proceeded their respective destinations as per ATC clearances without any other safety event. During this period, flight crew members were discussing the RA event. PIC was discussing with FO how TCAS RA "Level Off, Level Off" was generated

when the aircraft was maintaining FL180. FO was explaining that he was cleared to FL150, so aircraft was descending from FL180 to FL150.

PIC of AIC732 did file TCAS RA report and ATC also filed incident report as per regulatory requirements.

The incident was being investigated by DGCA before it was notified as Serious Incident by the AAIB. They submitted statements to Director of Air Safety, WR Mumbai on 12 October 2021 in which the flight crew did not mention anything about their fatigue while operating flight pattern AI 673/732 of October 5, 2021. They also did not mention any thing about tiredness/fatigue in their statements submitted to IIC through email dated 16 Nov 2021. Subsequently, during the personal interview by IIC, PIC expressed draining of energy /tiredness/fatigue during last sector i.e, Patna-Mumbai whereas FO reported tiredness during the sector 4 from Patna to Mumbai. PIC of AIC732 submitted fatigue report to M/s Air India on 6 October 2021 for flight pattern AI 673/732 which was forwarded to IIC by PIC on 11 December 2021 (through email).

1.1.3 Location of the Incident:

Approximately 40 NM North East of Mumbai Airport

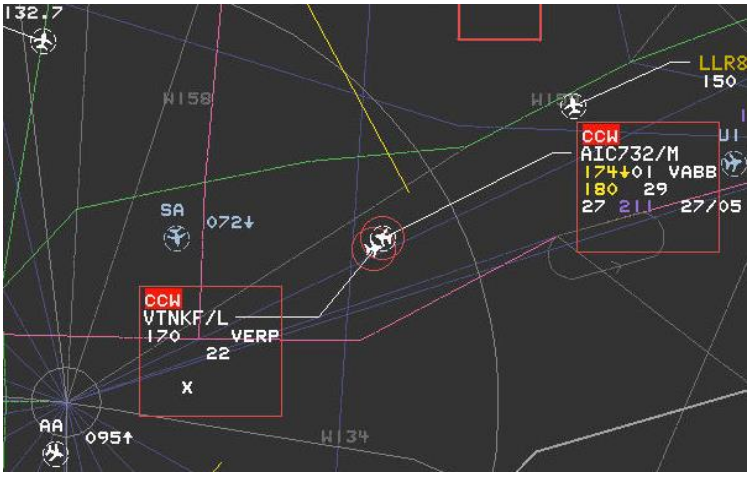

Figure 1

1.2 Injuries to persons.

There was no injury to any of the occupants on board on both the aircraft.

1.3 Damage to aircraft:

NIL

1.4 Other Damage

NIL

1.5 Personnel information:

1.5.1 Flight Crew of AIC732

	Pilot-in-command	**First Officer**
Licence No /Category	ATPL Holder	ATPL Holder
Valid up	20 June 2026	10 March 2025
Date of initial Issue	16 Dec 2009	11 March 2020
Class of Licence	Aeroplane	Aeroplane
Aircraft Ratings	A320 Family	A320 Family
Date of Endorsement as PIC	27 April 2012	Not endorsed
Age	42 years	28 years
Date of Medical Exam	6 April 2021	24 December 2020
Validity of Medical	3 April 2022	5 January 2022
ICAO Language Proficiency Level	6	6
FRTO License Validity upto	17 May 2022	17 September 2024
Date of last IR Check	3 June 2021	1 September 2021
Date of last proficiency check	21 July 2021	1 September 2021
Total Flying Experience	App. 9500^{+} hours	2572 hours
Total Flying Experience on type	Approx 9000 hours	2372 hours
Experience as PIC on type	Approx 3800 hours	-
Total Flying Experience during last 180 days	182:55 hours	130.09 hours
Total Flying Experience during last 30 days	59:59 hours	42.20 hours
Total Flying Experience during last 07 days	04:47 hours	12.18 hours
Total Flying Experience during last 24 hours	02:40 hours	02.47 hours
Rest period prior to reporting for duty on 5th October 2021	Approx 19 hours	Approx 19 hours
Flight Duty period for three days including the date of the incident		
2nd October 2021	No duty	16:20 to 22:43 IST
3rd October 2021	No duty	No duty
4th October 2021	04:45 to 10:06 IST	04:45 to 10:23 IST
5th October 2021	06:55 to 17:56 IST	06:55 to 17:56 IST

Both the flight crew members knew each other for almost last many years as per their statements/interview. Mumbai was home base for the both the flight crew members of AIC732. To maintain uniformity in assignment of flight numbers, M/s Air India Ltd. was using flight number range from 600 to 699 for domestic flights from WR (Mumbai). Majority of times the flight crew members of AIC732 operated flights starting with number “6”.

1.5.2 Flight Crew of VT-NFK

	Pilot-in-command	Co-pilot
Licence No/Category	CPL Holder	CPL Holder
Date of initial Issue	22 April 2007	10/07/2010
Valid upto	22 April 2022	11/07/2025
Class of Licence	Aeroplane Single/Multi- Engine	Aeroplane Single/ Multi-Engine
Endorsement as PIC	C-152A, BE-76, King Air B-200, C208B, King Air C90	C-152A, C-172, BE-76, King Air C90

Age	34 years	35 years
Date of Medical Exam	20 September 2021	22 January 2021
Validity of Medical	19 September 2022	27 January 2022
AELP	5	4
FRTO License valid upto	22 April 2022	11 July 2025
Date of last IR Check	17 August 2021	22 October 2020
Date of last proficiency check	17 August 2021	17 August 2021
Total Flying Experience	2631:45 hours	810: 15 hours
Total Flying Experience on type	143:35 hours	523: 40 hours
Total Flying Experience during 180 days	137:20 hours	46:05 hours
Total Flying Experience during 30 days	26: 25 hours	23:10 hours
Total Flying Experience during 07 days	03:15 hours	03:15 hours
Total Flying Experience during last 24 hours	02:10 hours	01:00 hours
Rest prior to reporting for duty on 5th October, 2021	21 hours	21 hours

1.5.3 Air Traffic Controller:

Age: The age of the controller was 46 years on the date of the incident.

Air Traffic Controller Licence and Ratings:

The Controller was issued Air Traffic Controller Licence on 13 November 2019 by the Licencing Authority (DGCA). He had following current valid ATC ratings at Mumbai Airport:

Area Control Surveillance	Area Control Procedural	Approach Control Procedural	Approach Control Surveillance	Oceanic Control Rating

The incident took place when the controller was providing area control surveillances services. He had been holding valid Area Control Surveillance Rating of Mumbai Airport since 24 April 2012. His last proficiency check was carried out on 28 July 2021 in Area Control Surveillance Unit and he demonstrated the required proficiency.

ICAO Language Proficiency Level 6 (six)

1.6 Aircraft information:

1.6.1 AIC732:

The A320-251N aircraft VT-EXQ was manufactured by M/s AIRBUS in 2019 and powered with LEAP-1A Engines. The last C of A was done on 18 February 2021 and was valid till 27 February 2022. The Aircraft held valid Flight Release Certificate (Certificate of release to service) which was issued on 01 September 2021 at Delhi.

The aircraft was equipped with ACAS II (TCAS II typeTPA100B, Change 7.1)

1.6.2 VT-NKF:

The C90B aircraft VT-NKF was manufactured by M/s Beech Aircraft Corpn, Wichita, USA in 1995 and had PT6A-21 Engines. The Aircraft had a seating capacity for 08 persons including cockpit crew. The aircraft was issued Airworthiness Review Certificate on 23 July 2021 and valid up to 24 July 2022.

The aircraft was not equipped with ACAS (TCAS) as it was twin engine turboprop aircraft having a seating capacity for 08 persons including cockpit crew. There was no regulatory requirement for such aircraft equipage with ACAS as per DGCA India CAR Section 2, Series I, Part VIII on "Installation of Airborne Collision Avoidance System". However, VT-NKF was equipped with Mode C transponder.

1.7 Meteorological Information

1.7.1 Local Forecast for VABB and 100 NM Around

METEOROLOGICAL OFFICE MUMBAI AIRPORT
LOCAL FORECAST FOR VABB & 100 NM AROUND

Time of issue :- YY/GGgg UTC :- 050530 UTC
Valid for :- YY/GGgg UTC to YY/GG 050600UTC TO 051400UTC

SURFACE WIND:- 330/10KT BECMG 0513/0514 010/05KT=

UPPER WINDS AND TEMPERATURES :-

Height in Meters	Wind Direction In Degrees	Wind Speed in Knots	Temperature in Degree Celsius	Height in Meters	Wind Direction in Degrees	Wind Speed in Knots	Temperature in Degree Celsius
16000	100	35	-79	4500	080	15	+04
13500	110	40	-66	3000	050	10	+12
12000	090	30	-51	2100	330	05	+16
10500	090	25	-39	1500	080	10	+20
9000	100	20	-29	900	010	15	+24
7500	100	15	-14	600	330	15	+25
5500	080	15	-04	300	320	15	+27

WEATHER: - HZ TEMPO 0508/0514 FBLTSRA MODSHRA=

VISIBILITY:- 3000M IN HZ BECMG 0508/0510 4000M IN HZ TEMPO 0508/0514 1500M IN FBLTSRA MODSHRA BECMG 0513/0514 3000M IN HZ=

CLOUDS :- SCT SC540M/600M SCT CU750M/3000M BKN AS/AC2700M/-- TEMPO 0508/0514 SCT ST300M/-- FEW CB900M/9000M BKN AS2400M/--- =

FREEZING LEVEL :- 5000M=

ADDITIONAL NOTES :- SEV/MOD TURB/ICING IN CB=

WARNING :- VISIBILITY MAY REDUCE TO 1500M OR LESS IN FBLTSRA MODSHRA BETWEEN 050800UTC TO 051400UTC=

SUNRISE:- --- SUNSET: - 05/1823 IST MOONRISE: - --- MOONSET: - ----

PHASE OF MOON:- ----
ISSUED AT 0530 UTC DATE : 05/10/2021

NOTE: ALL HEIGHTS ARE ABOVE MSL

1.7.2 Satellite Image (INSAT_3DR IMG):

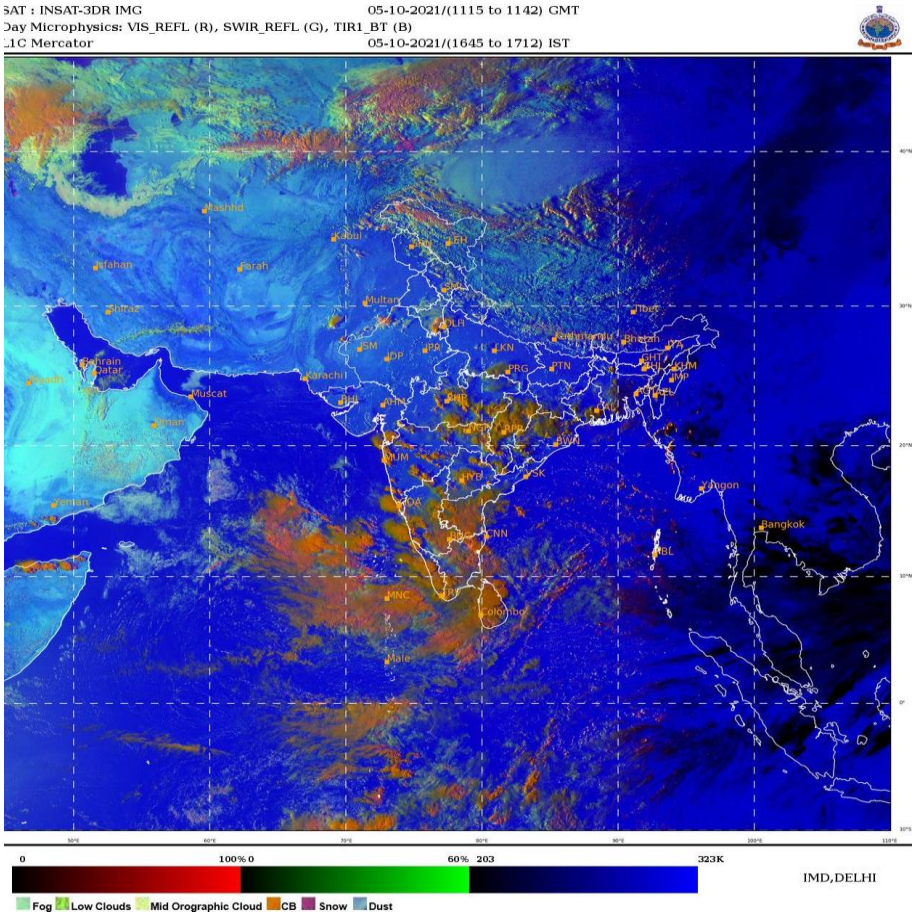

Figure 2

1.7.3 Mumbai Doppler Radar Image

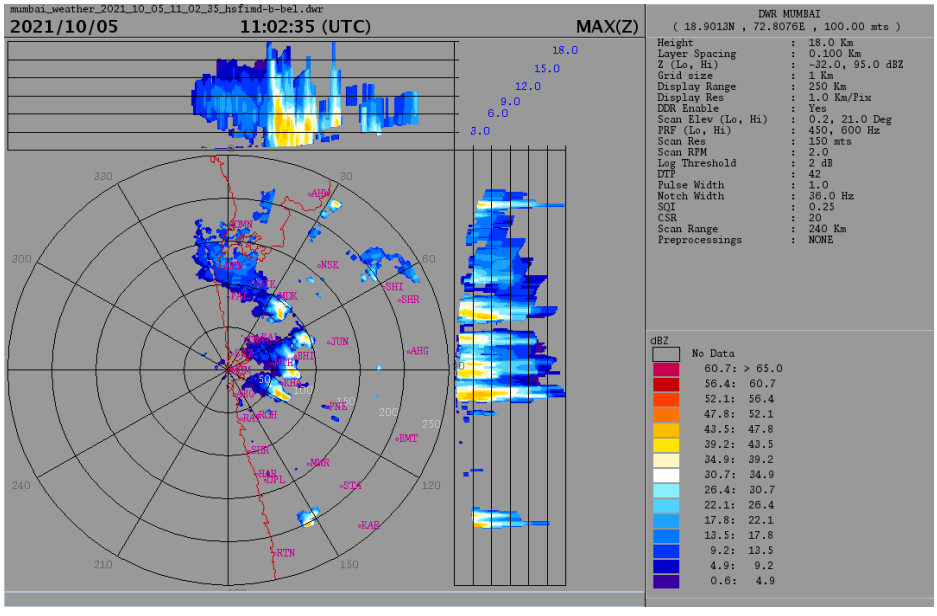

Figure 3

1.7.4 It was remote dispatch and self-briefing was carried out by the flight crew members of VT-EXQ.

1.7.5 Meteorological briefing was taken at Mumbai by the flight crew members of VT-NKF.

1.8 Aids to navigation:

AIC732 and VT-NKF were equipped with the standard navigation/approach aid equipment for the route to be flown. AIC732 had RNAV capability whereas VT-NKF was non RNAV aircraft. There were no reported technical failures of the navigation equipment of the aircraft.

Runways 27/09/14 at Mumbai were equipped with ILS. At the time of incident runway-in-use was 27. Other navigation aids included DVOR, DME and Outer locator were serviceable.

1.9 Communications:

Both aircraft AIC732 and VT-NKF were operating on Mumbai LAC frequency 133.425 MHz when the incident took place. The Air Traffic Services Provider at Mumbai provided the transcripts of the radio-communication of LAC.

LAC VHF 133.425 MHz had BSS (Best Signal Selection Capability) which was required to select best signal among the available VHF receivers. There was a manual provision for selecting the BSS capability by a controller. During the period when both aircraft were operating on LAC VHF 133.425 MHz, it could not be confirmed whether BSS was selected by the controller or not. In VCCS, logging/recording of switch selection was not available. Therefore, it was not possible to know whether BSS was selected or not.

The cross-coupling mode of operation was not available in existing VCCS at ATS Mumbai.

During the period when both the aircraft were operating on 133.425 MHz, no unserviceability/ performance degradation was recorded. However, on the day of the incident, at time 12:30 UTC (about 01:11 hours after the incident), a report was made about VHF performance by then air traffic controller on duty.

Previously, as per log entries made by ATCO on 24 September 2021, there were two occasions at time 09:00 UTC and 12:30 UTC when the controller was not able to receive communication from aircraft on 133.425 MHz.

On 5 October 2021 (day of the incident), SEJ6636 did read back the ATC clearance to descend to FL200 at time 11:09:43 but was not received by LAC on VHF 133.425. However, after listening the radio conversations on CVR of AIC732, it was established that SEJ6636 did readback the descent clearance given by the ATC but it was not received by ATC.

On the same day, at time 11:17:18, another aircraft AIC 644 was given descent clearance to FL150. The flight crew of AIC644 did readback the descent clearance as per CVR of AIC732 but this readback was not received by ATC on 133.425 MHz.

1.10 Aerodrome information:

Chhatrapati Shivaji Maharaj International Airport (IATA: BOM, ICAO: VABB) has two intersecting runways 09/27 and 14/32. It is one of the busiest airports which operate a single runway 09/27 at most of the time. Runway 14/32 is used only when the main runway is unavailable due to maintenance or other reasons.

The Area Control Centre which was providing area control surveillance services to the aircraft when the incident took place, is located in Mumbai ATS Complex. It also houses all other ATS units except Aerodrome Control Tower. The Meteorological Office which is responsible for providing meteorological services, is also located inside the Mumbai ATS Complex.

The arriving aircraft AIC732 was expecting arrival on runway 27 at Mumbai.

1.11 The Flight Recorders:

The data from Digital Flight Data Recorder (DFDR) of aircraft VT-EXQ involved in the incident was provided by the M/s Air India Ltd. and the relevant parameters were analysed. The recordings of four channels of Cockpit Voice Recorder (CVR) of VT-EXQ were made available for investigation. The recording timings of various events were extrapolated after adding elapsed time to CVR start time. The timings of ATC recordings and CVR recordings were not synchronized due to different sources of timing inputs to these systems. The CVR timings and ATC recorder timings were manually adjusted without making any impact to the analysis of various factors which contributed to the incident.

The other aircraft VT-NKF which was involved in the incident, continued the flight to its flight-planned destination after the airprox incident. Since the flying time to planned destination exceeded the CVR recording capability, the CVR recording was not made available for review. The aircraft was not equipped with DFDR which was not required as per relevant DGCA CAR.

1.12 Wreckage and impact information

There was no damage to either of the aircraft.

1.13 Medical and pathological Information

There was no reported adverse medical condition of the flight crew members of both aircraft AIC732 and VT-NKF. The flight crew of AIC732 did not undergo Breath Analyser (BA) Test however, they signed a declaration as per DGCA order – 15031/4/2020-DAS dated 29.03.2020 before operating the flight from Mumbai. The flight crew of VT-NKF were subjected to Breath Analyser (BA) Test before undertaking the flight.

1.14 Fire

There was no fire.

1.15 Survival aspects

The incident was survivable.

1.16 Tests and research:

Nil

1.17 Organizational and management information

1.17.1 Airports Authority of India (AAI): The Air Traffic Services including Area control services at Mumbai, were being provided by Airports Authority of India (AAI). AAI was constituted by an Act of Parliament and came into being on 1st April 1995, entrusted with the responsibility of creating, upgrading, maintaining and managing civil aviation infrastructure both on the ground and air space in the country.

The Manual of Air Traffic Services - Part1 (MATS-Part1) issued by the AAI Corporate Head Quarters provides processes, procedures and instructions that are essential for the provision of safe

and efficient air traffic services within the airspaces under the jurisdiction of AAI and at airports where air traffic services are provided by AAI. Following para of MATS-Part 1 (6th Edition) provided information and instructions to air traffic controllers on ensuring readback of safety-related parts of the clearances and instructions.

"Para 12.9.3 of MATS-Part 1: Read back requirements have been introduced in the interests of flight safety. The stringency of the read back requirement is directly related to the possible seriousness of a misunderstanding in the transmission and receipt of ATC clearances and instructions. Strict adherence to read-back procedures ensures not only that the clearance has been received correctly but also that the clearance was transmitted as intended. It also serves as a check that the right aircraft, and only that aircraft, will take action on the clearance.

Para 12.9.5 of MATS-Part1: The controller shall listen to the read-back to ascertain that the clearances has been correctly acknowledged by the flight crew and shall take immediate action to correct any discrepancies revealed by the read-back"

1.17.2 Air India Limited:

1.17.2.1 Air India Limited was incorporated under the Companies Act 1956 on 30 March 2007 and is owned by the Government of India. It has a large fleet of aircraft which also includes A320-251N. Operational Manual Part B Issue 1 contains Company Standard Operating Procedures (CSOP) for the Airbus 320 family for the use of flight crew members. This Manual also contained following procedures for use of headset, FCU operations, FMA call outs, descent preparation and R/T Procedures.

"***9.0 RADIO USAGE***

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……..

The flight crew must use the Headset:

From Engine Start Phase (Including during Pushback) till 10000ft

From 10000ft in Descent Phase until the aircraft is parked and Parking Checklist completed.

……..

17.0 BEFORE PUSHBACK/START: (FCOM-PRO-NOR-SOP-7)

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***HEADSET**: headset shall be worn by all crew members.*

From the time the crew commences COCKPIT PREP / BRIEFING till 10,000 feet and <u>also in the area of heavy ATC communication.</u>

……

<u>When briefings are conducted in order to enhance the clarity of briefings</u>.

From 10,000 feet during descent till completion of parking checklist.

……..

At all other times as per the discretion of the commander.

7.2 FCU OPERATIONS

Page 11

With the autopilot engaged, FCU selections should be made by the PF. When receiving an altitude clearance, set the cleared altitude value immediately.

<u>Read back to ATC should be of the altitude set</u>.

Altitude selections may be made by the PM when the PF is occupied.

……..

It is important that both pilots be kept in the loop on all FCU selections. The results of any selection on the FCU must be checked on the PFD. The FMA and effect on the flight path must be monitored.

Any FMA change must be announced, normally by the PF and crosschecked by the PM. More importantly, if an FMA change is expected, and no change was seen, a negative callout is essential e.g. "No ALT Green".

7.3 FMA CALLOUTS

Page 12

FMA call outs shall be made by the PF and must be acknowledged by the PM.

The PM shall, however, call out the FMA mode changes if the PF has missed them.

The PF shall call out any FMA change, ……..

26.0 DESCENT PREPARATION: (FCOM-PRO-NOR-SOP-16)

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All preparation and briefing should be done before TOD. Descent preparation and approach briefing can take approximately 10 min, so they should be initiated at least 80 NM before TOD.
PF normally prepares the FMGS for the arrival and is cross checked by PM. However, PF should always be aware of the workload demand and should delegate the FMGS preparation to PM when necessary.
……
37.0 R/T PROCEDURES

Page 53
……..
All clearances are to be read back VERBATIM.
……..."

1.17.2.2 M/s Air India Limited was required to comply with the requirements as given in DGCA CAR Section 7 – Flight Crew Standards Training and Licensing, Series 'J' Part IV Issue I, dated 23rd March 2021, effective: 23rd March 2021 on the subject "Duty Period, Flight Duty Period, Flight Time Limitations and Rest Periods: Flight crew engaged in Scheduled Commuter, Non-scheduled, General Aviation (including State Government and PSU) Fixed Wing Operations". Some of the requirements enumerated in this CAR are as appended below:

Para 2.3

No operator / flight crew engaged in such operations shall operate beyond 30 September 2021 unless the requirements of this CAR are complied with.

NOTE: Existing Operators, holding approval of FDTL scheme as per CAR Section 7 Series J Part III, issue II, dated 11th August 2011 need to implement the stipulated requirements w.e.f 30 September 2021 and accordingly amend their respective Operations Manual.

Para 4.10

"Fatigue Report Management. Fatigue reports shall be used as effective tool in identifying and mitigating crew fatigue. Each Operator shall establish a clear policy with respect to fatigue reports. The policy should state not only 'how to raise' a report but also 'what to do' in response to a fatigue report. Executive responsibility for addressing fatigue management shall be defined by the operator".

1.17.3 M/s Pinnacle Air Ltd.: M/s Pinnacle Air Ltd. is an Indian non-scheduled operator based in Delhi. The airline operates passenger charters to destinations across the country. Its fleet of aircraft also includes King Air C90A and C90B. VT-NKF, the aircraft involved in the incident, was operated by M/s Pinnacle Air Pvt. Ltd. They had a tie-up with E-Flight for generation of Flight Plans. E-Flight used to file Flight Plans with concerned agencies & obtain flight clearances. They

also used to generate a Trip kit consisting of Flight Plans, Nav logs, Weather Reports & NOTAM Information and hand over to the flight crew.

1.18 Additional Information

1.18.1 ATM Automation System:

The air traffic controller was providing surveillance services using ATC automation system known as AutoTrac III. It is a state-of-the-art system that enables users to perform automated air traffic management. The AutoTrac III provides automated real-time radar data, surveillance data and flight data processing, predicts and detects conflicts between aircraft, airspace and terrain, performs on-line recording and playback for accident/incident investigation or controllers training. A GPS is source of timings to ATS automation system. The automation system has capability to generate Short-term conflict alert (STCA) which is an automated warning system for air traffic controllers (ATCO) intended to assist them in preventing collision between aircraft by generating, in a timely manner, an alert of a potential or actual infringement of separation minima.

A conflict warning generated for potential infringement of separation minima is known as PCW (Predicted Conflict Warning). On the day of the incident, PCW for AIC732 and VTNKF was generated on the controller's situation display in yellow colour as depicted in figure 4 below:

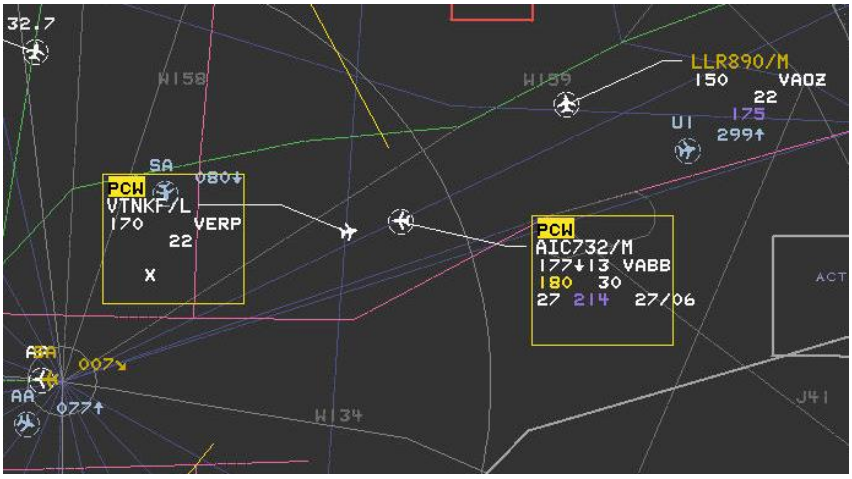


Figure 4

A conflict warning is generated for the actual infringement of separation minima is known as CCW (Current Conflict Warning). On the day of the incident, a CCW for AIC732 and VTNKF was generated on the controller's situation display in red colour as depicted in figure 5 below:

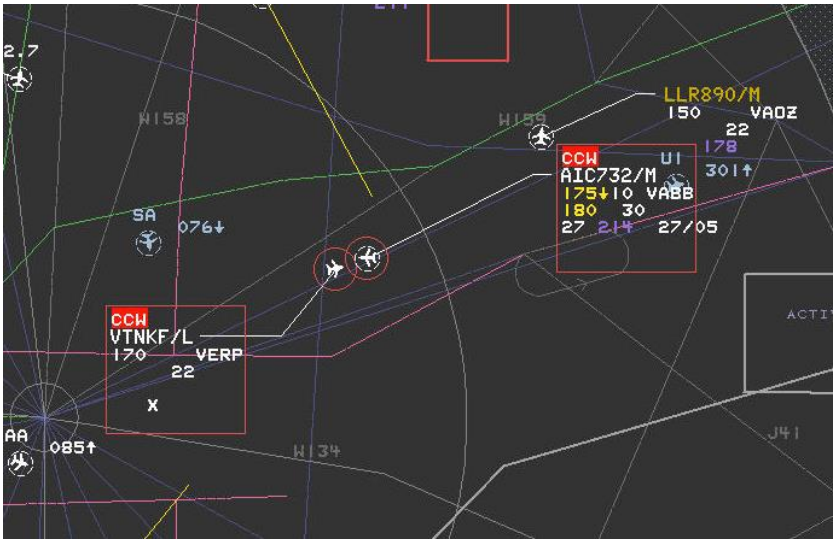


Figure 5

AutoTrac-III system at Mumbai also displays two distinct alerts (warnings) to the controllers in the events of vertical non-conformance. The data label of the concerned aircraft displays these alerts and there is no audio indication. There are two types of vertical non-conformance warnings as appended below:

- Altitude Non-Conformance Warning: This warning changes the colour of the Present Altitude (Mode-C) and the VMI vertical movement indicator field to yellow when there is a difference between the current altitude and the expected altitude in the profile of the current clearance. This alert is available for all aircraft with a serviceable Mode-C and a valid current clearance.
- CFL (Cleared Flight Level) Non-Conformance Warning: This warning changes the colour of the CFL field to yellow, after an interval of 50 seconds when a difference between the CFL and the SA (Selected Altitude – a downlink parameter) occurs. This alert is available only for the aircraft for which DAP is available either using Mods S or ADS-B.

On the day of the incident, the above warnings were generated for AIC732 on the controller's situation display having visual depiction in same colour (yellow) as given below in figure 6:

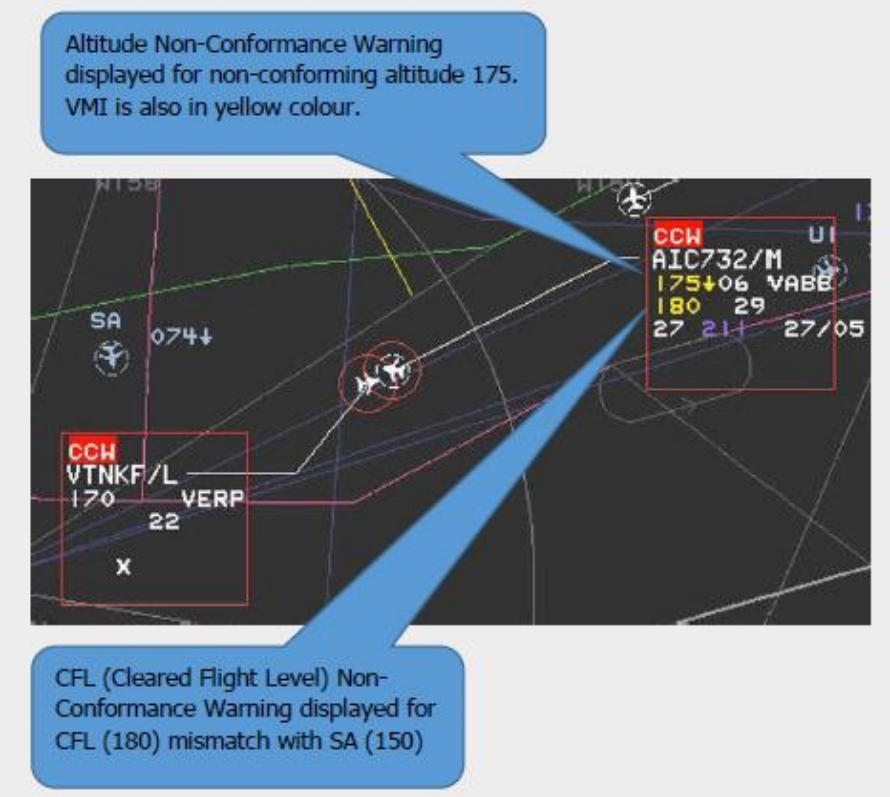


Figure 6

1.19 Useful or effective investigation techniques:

NIL

2 ANALYSIS:

2.1 Weather Aspects

The local forecast for Mumbai and 100 NM around Mumbai issued at 05:30 UTC valid from 06:00 UTC to 14:00 UTC clearly indicated that there might be few cells of CB during the period 06:00 UTC to 14:00 UTC in North East of Mumbai. Satellite image of the period 11:15 UTC to 11:42 UTC was clearly showing that there were few CB cells enroute from Patna to Mumbai. Doppler radar (Mumbai) image 11:02:35 UTC also showing CB cells in the NE of Mumbai, in the airspace where AIC732 and VTNKF were flying. The flight crew of AIC732 aware of adverse weather conditions, particularly about CB cells requiring weather avoidance action.

2.2 Human Factors Aspects and adherence to SOP

Flight Crew of AIC732:

One cannot expect two individuals who are known to each other and working long hours side by side not to speak with one another and never discuss things outside their professional fields. PIC and FO of AIC732 were not exceptions to this fact. Since they were known to each other for last many years, their non-flight-related conversations were longer than expected, more frequent and louder. The distraction primarily due to non-flight-related conversations between flight crew, led to non-adherence of SOP for completing approach briefing before the top of the descent. Further, even after commencement of descent, PIC and FO did many non-flight-related conversations. These resulted into a situation where they left with a feeling of being rushed and faced with competing tasks like Approach briefing, managing busy ATC radio congestion, managing descent and circum-navigating CB cells. When being faced with concurrent task demands, natural human limitations result in performing one task to the detriment of another. The Airlines SOP did provide procedures for flight crews when check list callouts are interrupted but they did not adhere to.

During the approach briefing, ATC issued descent clearance to AIC 644 to which FO (PF) took as clearance for own aircraft and selected altitude 15000 feet on FCU. Since all domestic flights originating from WR(Mumbai) on AI network were starting with "AIR INDIA SIX", and also FO(PF) had own expectations to descend to F150 based on own position of aircraft, multiple aircraft being given descent clearances to FL150 by the controller and his past experience of operating flights at Mumbai airport resulted into his expectancy bias towards accepting descent clearance issued to AIC 644 as own clearance. Since the FO(PF) did not callout the altitude set while making FCU altitude selection and also did not readback ATC clearance, the error made by FO(PF) remained unnoticed by the PIC(PM). PIC was communicating with ATC and had channelized attention on CB cells while avoiding adverse weather, and did not observe the FCU selected altitude. PIC allowed letting his attention linger long on one task, in place of switching attention back and forth every few seconds between tasks.

PIC of VT-EXQ reported for flight duty at 06:55 IST after a rest period of about 19 hours and the incident occurred at around 16:49 IST. This amounted to a total 'duty period' of 09:54 hours till the time of incident. The FO was provided off duty period of about 19 hours before reporting for the duty for undertaking flight VT-EXQ from Mumbai on 5 October 2021. As per DGCA CAR Section 7 Flight Crew Standards, Training and Licensing, Series J, Part IV on "Duty Period, Flight Duty Period, Flight Time Limitations and Rest Periods: Flight crew engaged in Scheduled Commuter, Non-scheduled, General Aviation (including State Government and PSU) Fixed Wing Operations", the flight duty duration was within acceptable limits. There was no violation of

Operator's Flight Crew FDTL Scheme of M/s Air India Ltd. There was no fatigue report by flight crew members before reporting for duty on 5th October, 2021. PIC of AIC732 filed fatigue report on 6 October 2021 (a day after the incident) to M/s Air India Ltd for flight pattern AI 673/732 of October 5, 2021. The flight crew members of AIC732 dated 5 October 2021 had never operated such flight pattern in the past consisting of operating twice at the critical airport, Patna on the same day. No other flight crew filed fatigue report in the past after operating similar flight pattern.

However, as per CVR recordings of AIC732 (VT-EXQ), the intensity and frequency of extraneous non-flight-related conversations and verbal expressions during the Patna-Mumbai sector, did not suggest fatigue factor in this particular safety occurrence. The response of PIC to TCAS RA event was very timely and speech was normal, well composed and full of confidence. Therefore, investigation did not find fatigue as a contributory factor to the TCAS RA incident.

2.3 Communication aspects:

Use of headsets by the flight crew:

There was heavy communication congestion due to deviations of aircraft from intended tracks and traffic complexity in the airspace under the control of LAC. Flight crew members of AIC732 were not using headsets even when there was heavy ATC communication congestion and conducting briefings. However, DGCA approved CSOP (Company Standard Operating Procedures) for the Airbus A320 family- Operations Manual Part-B do not provide explicit procedures for use of headsets in the area of heavy ATC communication congestion or conducting briefings when arriving aircraft is above 10000 feet. Since the use of headsets improves the reliability of ATC communications during more demanding periods, it could have helped flight crew members in better understanding of ATC clearances and enhancement of the clarity of briefings.

ATC and aircraft Communication aspects:

During the period of last 30 days before the incident, there were two occasions on 24 September 2021 when the controller did not receive the aircraft transmissions. On the day of the incident during the period when AIC732 was in contact with ATC, there were two aircraft which readback ATC clearances but those were not received by the controller. When the controller issued instruction to AIC644 to descend to FL150, AIC644 started readback of ATC clearance to descend to FL150 which was not being received by the controller. Since he did not receive readback from aircraft, he repeated the descent clearance to AIC644. The readback of the AIC644 was partially blocked by the second time descent clearance issued by ATC to AIC644. However, decent clearance to AIC644 by ATC and its readback by the aircraft was very much readable in the cockpit of AIC732 as per CVR. ATC tape recordings, CVR recordings and selected altitude on FCU by the flight crew are as appended below:

Time 11:17:18 to 11:17:30 UTC		
ATC Tape recording	**CVR recording** (Approach Briefing in Progress by FO/PF)	**DFDR FCU selected altitude**
AIR INDIA SIX FOUR FOUR NAMASKAR DESCEND TO FLIGHT LEVEL ONE FIVE ZERO, AIR INDIA SIX FOUR FOUR* * *Voice of ATCO*	DESCEND FLIGHT LEVEL ONE FIVE ZERO AIR INDIA SIX FOUR FOUR * ONE FIVE ZERO**	At 11:17:30 FCU selected altitude was changed from 18000 ft to 15000
AIR INDIA SIX FOUR FOUR DESCEND TO FLIGHT LEVEL ONE FIVE ZERO	**Voice of flight crew member of AIC644*	

** Voice of ATCO*	***Voice of ATCO*	

The controller, after repeating descent clearance to AIC644, did not further challenge AIC644 for readback. Had he challenged to AIC644, possibly it would have given a clue to the flight crew of AIC732 that clearance to FL150 was not meant for them. Since there were many other aircraft deviating from assigned tracks leading to potential conflicts, the controller's focus shifted in dealing with approval of aircraft deviations and resolving potential conflicts.

This degraded performance of VHF receiver was not known to the controller and the pilots. On the day of the incident, about 01:11 hours after the incident, a report was made about performance of VHF by then air traffic controller on duty.

2.4 The incident:

The AIC732 was at FL180 when FO(PF) selected the altitude 15000 feet on FCU at time 11:17:30 UTC. However, the aircraft did not vacate FL180 till 11:18:22 UTC. Immediately after leaving FL180, AIC732 came in conflict with opposite direction traffic VT-NKF, King Air C-90B. Within few seconds, PCW (Predicted Conflict Warning) was generated at the controller's situation display for alerting him about the potential infringement of separation minima. The controller issued instruction to turn right heading 360 but during this period TCAS TA followed by TCAS RA was generated in the cockpit. Therefore, flight crew members of AIC732 did not immediately respond to the controller. The controller passed essential traffic information to both aircraft. The vertical separation reduced to 400 feet and horizontal (lateral) separation was about 1 NM. During the TCAS RA and post recovery, response of PIC to ATC was well composed of and appropriate to ATC instructions. Since VT-NKF was not equipped with TCAS, flight crew did not receive any TCAS alert. However, VT-NKF was equipped with transponder Mode C, therefore was a candidate for generation of TCAS RA event for AIC732.

2.5 Safety Nets:

a) **Readback**: The FO(PM) of AIC732 who had selected altitude 15000 feet on FCU, did not readback the (misunderstood) descent clearance. Probably, had he readback the decent clearance, the controller would have corrected him and incident could have been avoided. The controller also did not challenge AIC644 for readback. Had he challenged for readback, possibly FO of AIC732 could have realized about his mis-understanding of clearance.

b) **Callout:** Both the flight crew members were not in the loop on FCU selections. Callout by FO(PF) for FCU selected altitude was not done which reduced the possibility of detecting the wrong selection of altitude on FCU. FMA call out was not made by the FO(PF) and therefore, it was not acknowledged by the PIC(PM).

b) **Reduced Situational Awareness of PIC of AIC732:** Distraction due to extraneous non-flight-related conversations and channelised attention of PIC towards avoidance of CB resulted into reduced situational awareness.

c) **CFL (Cleared Flight Level) Non-Conformance Warning**: In spite of all of the above failures of safety net, had CFL (Cleared Flight Level) Non-Conformance Warning was optimized to generate warning in prominent colour to the controller within few seconds say 5 sec after difference in FCU selected altitude and CFL input by the controller, the incident could have been averted by the controller.

d) **Short Term Conflict Alert (STCA)**- It was an effective tool in generation of an alert to controller for potential/actual infringement of separation and initiating conflict avoidance action.

e) **TCAS RA:** It was highly effective collision avoidance tool which helped in avoidance of any mishap.

2.6 Organisational Factors:

There was no fatigue report by the flight crew of flight pattern AI 673/732 of October 5, 2021 before undertaking the flight from Mumbai. M/s Air India informed that fatigue report was filed on 6 October 2021, one day after the completion of duty on 5 October, 2021 and flight crew were grounded by DGCA on 5 October 2021, therefore, no fatigue action was initiated by the M/s Air India Ltd. In fact, M/s Air India Ltd. had no formal Fatigue Report Management on the date of the incident to deal with such fatigue report as of filed by PIC of AIC732.

Thus, they did not comply with the DGCA CAR Section 7 – Flight Crew Standards Training and Licensing, Series 'J' Part IV Issue I, Dated 23rd March 2021, effective: 23rd March 2021.

Further, M/s Air India Ltd. continued their operations beyond 30 September 2021 without complying with the requirements of establishing Fatigue Report Management as given in para 4.2 of above said DGCA CAR.

2.7 Other issues having safety deficiencies which did not contribute to the incident:

a) Flight Plan filed by M/s Pinnacle Air:

M/s Pinnacle Air Pvt. Ltd., had earlier filed Flight Plan (FPL) of VT-NKF having type of aircraft as C90A in item 9 of the ICAO FPL whereas the type of aircraft was C90B as per list of non-scheduled operators dated 15 October, 2021 published by the DGCA. Based on FPL information, the serious incident notification contained the type of this aircraft as C90A in place of C90B. However, since C90A and C90 B have almost similar aircraft profile for ATS, it did not make any difference. Wrong information about type of aircraft to ATS has serious implication on working of ATC. Also, SAR agencies might not provide appropriate level of SAR services to the aircraft when needed.

As per Appendix 2 of ICAO DOC PANS ATM, in item 9 of the Flight Plan, the type of aircraft shall be appropriate designator as specified in ICAO DOC 8643, Aircraft Type designators. In this case, the aircraft type designator should have been BE9L which was not known to the flight crew members of VT-NKF, Agency (E-Flight) responsible for filing flight plan and Operations personnel of M/s Pinnacle Air Pvt. Ltd.

b) Logging/recording of various selections in VCCS in ATC Units:

VCCS at ATS Mumbai was not capable of logging/recording of switch selection in VCCS due to which the investigation could not establish whether BSS was selected or not. Such capability of VCCS would help in investigation of an incident.

3 CONCLUSIONS:

3.1 Findings:

a) The air traffic controller providing area control surveillance services was holding a valid Air Traffic Controller's Licence and had a valid Area Control Surveillance Rating at the time of the incident. He was medically fit and his ICAO Language Proficiency Level was six.

b) AIC732 (VT-EXQ), A320-251N was a scheduled flight operated by M/s Air India Limited from Patna Airport to Mumbai Airport. PIC and FO were ATPL holders and medically fit. The ICAO Proficiency Level of each of the flight Crew members was six.

c) VT-NKF, King Air C90B was a non-scheduled flight operated by M/s Pinnacle Air Pvt. Ltd. from Mumbai Airport to Raipur Airport. The Pilot and Co-pilot were CPL holders, medically fit and had ICAO Language Proficiency Levels of five and four respectively.

d) The flight crew members of AIC732 and VT-NKF were in compliance with the prescriptive hours of FDTL regulations.

e) E-Flight, on behalf of the M/s Pinnacle Air Pvt. Ltd. filed flight plan of VT-NKF having C90A as type of aircraft in item 9 of ICAO Flight Plan Format whereas the correct type of aircraft was C90B and ICAO type designator as provided in ICAO DOC 8643 was BE9L. The flight crew members of VT-NKF, Agency (E-Flight) responsible for filing flight plan and Operations personnel of M/s Pinnacle Air Pvt. Ltd. were not aware about requirement of filing ICAO type designator of aircraft in item the 9 of the ICAO flight Plan format.

f) AIC732 was equipped with TCAS II Change 7.1.

g) VT-NKF was not equipped with TCAS. However, VT-NKF was equipped with transponder Mode C.

h) There was heavy communication congestion due to deviations of aircraft from intended tracks and traffic complexity in the airspace under the control of LAC.

i) There were few CB cells along the flight planned route of AIC732 and VT-NKF, particularly within100 NM NE of Mumbai, requiring weather avoidance action by flight crew of AIC732 and VT-NKF. Flight crew of AIC732 and VT-NKF were circumnavigating CB cells.

j) "CSOP (Company Standard Operating Procedures) for the Airbus A320 family- Operations Manual Part-B" of M/s Air India Ltd. did not provide explicit procedures for use of headsets in the area of heavy ATC communications or conducting briefings when arriving aircraft was above 10000 feet. Therefore, there was no mandate for flight crew members of AIC732 for using headsets during such conditions.

k) The flight crew members had many non-essential conversations before the top of descent and also during the descent which resulted into diversion of their attention away from impending tasks like approach briefings.

l) The reliability of VHF 133.425 receiver was not assured which was not known to the controller and pilots.

m) The air traffic controller issued descent clearance of FL150 to arriving aircraft AIC644 which was readback by the flight crew of AIC644 but the controller did not receive the readback of descent clearance. He repeated the clearance but did not ensure readback by the flight crew of the flight for which it was intended.

n) When approach briefing was in progress in cockpit of AIC732, there was human errors on part of FO (PF) in accepting the descent clearance meant for AIC644 due to his expectation bias and selecting an altitude of 15000 feet on FCU without confirmation of ATC descent clearance. FMA call out was not made by the FO(PF) and therefore, it was not acknowledged by the PIC(PM)

o) FO (PF) permitted the aircraft to commence descent below 18000 feet.

p) PIC of AIC732 did not exhibit the required level of situational awareness in respect of monitoring the FCU selected altitude due to channelised attention towards CB cells, communicating with ATC and distraction.

q) When aircraft AIC732 vacated 18000 feet, came in conflict with opposite direction traffic VT-NKF which was maintaining FL170. TCAS Traffic advisory followed by TCAS RA was generated. The PIC took over the control from FO and the flight crew members of AIC732 promptly responded to TCAS RA for avoiding any possible mishap.

r) CFL Non-Conformance Warning for AIC732 was generated about 50 seconds after FCU selection /controller's CFL input to ATC system due to design parameters which was too late for the controller to take any action for avoiding the infringement of applicable separation minimum.

s) Short-Term-Conflict Warning was generated as per system design parameters on the controller's situation display. The controller issued conflict resolution instructions but during this period, the flight crews of AIC732 were dealing with TCAS RA event.

t) The controller passed essential traffic information to both the aircraft AIC732 and VT-NKF.

u) Both the aircraft, after clear of traffic, proceeded to their destinations as per ATC clearances.

v) PIC of AIC732 did file TCAS RA report and ATC also filed incident report.

w) There was no violation of Operator's Flight Crew FDTL Scheme of M/s Air India Ltd. The flight crew did not report any fatigue before operating flight from Mumbai on 5 October 2021. PIC filed Fatigue report to M/s Air India Ltd. on 6 October 2021 for flight pattern AI 673/732 of October 5, 2021, one day after the date of incident. However, based on the extraneous conversation between cockpit crew members, communication of PIC with ATC and his subsequent prompt action to follow TCAS RA, the investigation of the incident did not find fatigue as a contributory factor to the incident.

x) M/s Air India Ltd. had no formal Fatigue Report Management on the date of the incident. They continued their operations beyond 30 September 2021 without complying with the requirements of establishing Fatigue Report Management as given in para 4.2 of DGCA CAR Section 7 – Flight Crew Standards Training and Licensing, Series 'J' Part IV Issue I, Dated 23rd March 2021, effective: 23rd March 2021.

3.2 Probable Causes:

The loss of separation that characterized this serious incident was due to an error on part of FO (PF) in accepting the descent clearance meant for another aircraft due to his expectation bias. Further he selected an altitude of 15000 feet on FCU without confirmation of ATC descent clearance and permitted the aircraft to commence descent. The PIC (PM) did not trap the said error due to distraction.

3.3 Contributory Factors

The following were identified as contributing factors to the serious incident:

a) Non-essential conversations between flight crew members of AIC732 before the top of descent and during the descent causing them to be out of the loop;

a) Adverse weather conditions;

b) Exhibition of reduced situational awareness on the part of PIC of AIC732 by not monitoring the FCU selected altitude;
c) Non-adherence to SOP by flight crew of AIC732 regarding FCU selected altitude and readouts;
d) Unreliable performance of receiver of VHF 133.425 MHz
e) Inadequate effort by the air traffic controller to ensure readback from the flight crew of the aircraft to whom descent clearance was given; and
f) Late generation of CFL Non-Conformance Warning to the air traffic controller due to design parameters.

4 SAFETY RECOMMENDATIONS

4.1 M/s Air India Ltd.

1) It is recommended that M/s Air India Ltd should include one module on management of distraction in CRM training.

2) It is recommended that M/s Air India Ltd. should review CSOP (Operations Manual Part B) on use of headset during different phases flight and conditions, and take appropriate action in line with industry best practices.

3) It is recommended that M/s Air India Ltd. should ensure that flight crew readback the safety-related parts of ATC clearances and instructions which are transmitted by voice.

4) It is recommended that M/s Air India Ltd. should ensure flight crew adhere to SOP on FCU operations and FMA callouts, and also follow the Airbus Golden Rules.

5) It is recommended that M/s Air India Ltd should deal Fatigue reports similar to one as filed by the PIC of AIC732 after the incident. M/s Air India should implement Fatigue Report Management to ensure issues related to fatigue are addressed.

4.2 M/s Pinnacle Air Pvt. Ltd.

1) It is recommended that M/s Pinnacle Air Pvt. Ltd. should ensure flight plan of the aircraft are filed in the ICAO Flight Plan format as per instructions and guidance given in Appendix 2 of ICAO DOC 4444 (PANS-ATM).

4.3 Airports Authority of India (AAI)

1) It is recommended that AAI should take action to ensure availability and reliability of VHF voice communication. Feedback of the users i.e., controllers and pilots should be considered before deciding the availability and reliability of such communication system.

2) It is recommended that AAI should take suitable steps for sensitisation of the air traffic controllers about correct communication procedures and importance of readback of safety-related parts of the ATC clearances by the flight crew.

3) It is recommended that AAI should ensure to have a system of a logging/recording of switch selection in VCCS whenever VCCS upgradation/replacement at an ATS Station is considered.

4) It is recommended that AAI should review of the time (interval) parameter for generation of CFL Non-Conformance Altitude Alert and its visual depiction on the situation display of an air traffic controller when such condition exists.

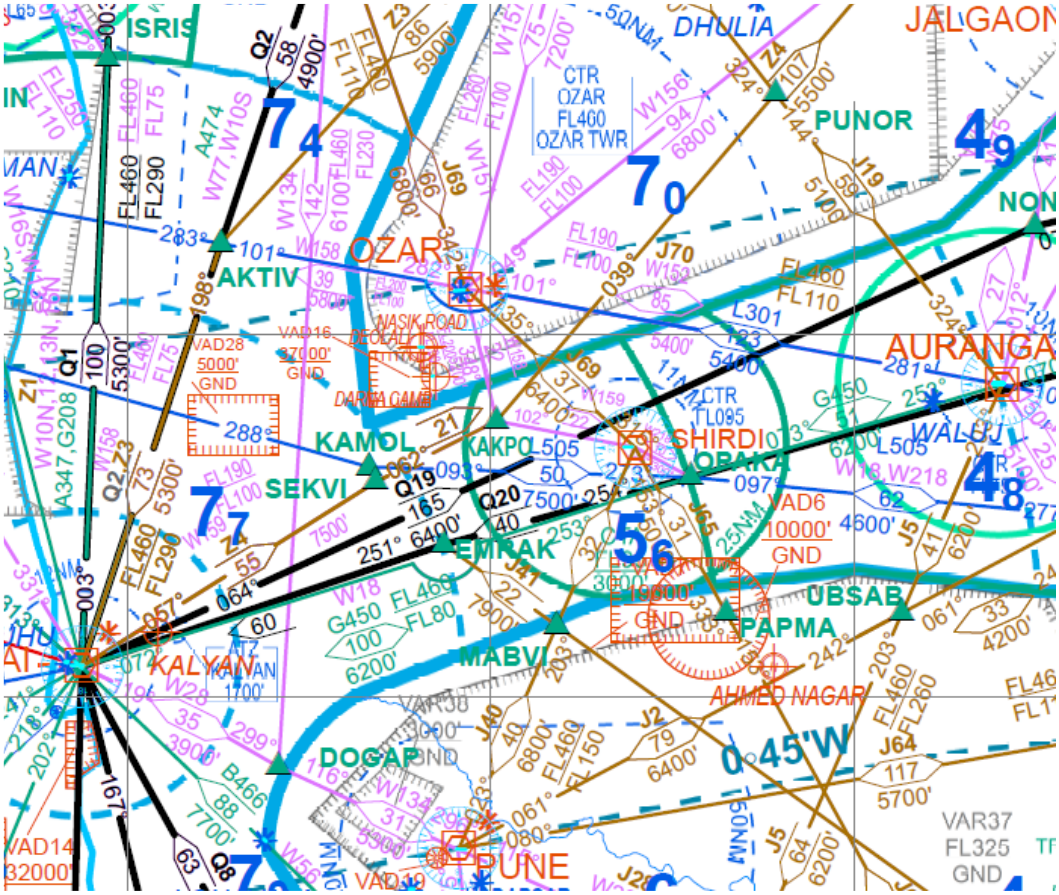
5) It is recommended that AAI should implement CFL Non-Conformance Alert at all the ATS Centres/Units where ATC automation System with Mode S downlink capability have been provided/planned to be provided and traffic density is high as it is an effective safety tool for detecting human errors on account of wrong FCU selected altitude by flight crew, wrong CFL input to data block of an aircraft by an air traffic controller, unintended level clearance to aircraft by an air traffic controller and uncorrected erroneous readback by a pilot.

Place New Delhi

Date 17.01.2022

(KANHAYA LAL)
General Manager (ATM)-Retired, AAI
Investigation-in-Charge

Part of Mumbai TMA containing the segments of ATS Routes in NE Sector



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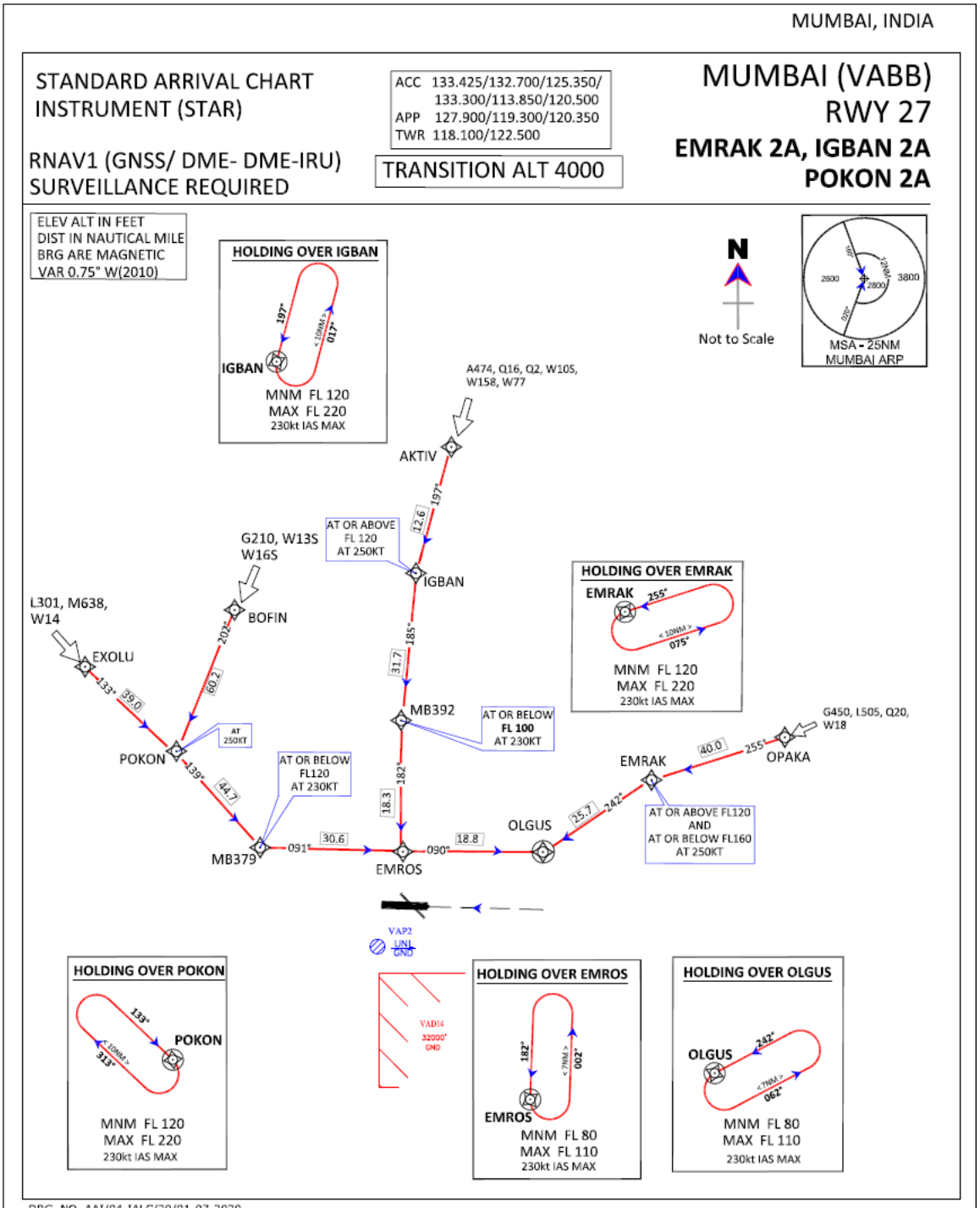
MUMBAI, INDIA
STANDARD ARRIVAL CHART
INSTRUMENT (STAR)
RNAV1 (GNSS/ DME- DME-IRU)
SURVEILLANCE REQUIRED
ACC 133.425/132.700/125.350/
133.300/113.850/120.500
APP 127.900/119.300/120.350
TWR 118.100/122.500
TRANSITION ALT 4000
MUMBAI (VABB)
RWY 27
EMRAK 2A, IGBAN 2A
POKON 2A
ELEV ALT IN FEET
DIST IN NAUTICAL MILE
BRG ARE MAGNETIC
VAR 0.75° W(2010)
HOLDING OVER IGBAN
IGBAN
MNM FL 120
MAX FL 220
230kt IAS MAX
N
Not to Scale
MSA - 25NM
MUMBAI ARP
A474, Q16, Q2, W10S,
W158, W77
AKTIV
197°
12.6
AT OR ABOVE
FL 120
AT 250KT
IGBAN
G210, W13S
W16S
BOFIN
202°
60.2
L301, M638,
W14
EXOLU
133°
39.0
HOLDING OVER EMRAK
EMRAK
255°
075°
MNM FL 120
MAX FL 220
230kt IAS MAX
185°
31.7
MB392
AT OR BELOW
FL 100
AT 230KT
AT
250KT
POKON
139°
44.7
AT OR BELOW
FL120
AT 230KT
182°
18.3
MB379
091°
30.6
EMROS
090°
18.8
OLGUS
25.7
242°
EMRAK
40.0
255°
OPAKA
G450, L505, Q20,
W18
AT OR ABOVE FL120
AND
AT OR BELOW FL160
AT 250KT
VAP2
UNL
GND
VAD14
32000'
GND
HOLDING OVER POKON
133°
313°
POKON
MNM FL 120
MAX FL 220
230kt IAS MAX
HOLDING OVER EMROS
182°
002°
EMROS
MNM FL 80
MAX FL 110
230kt IAS MAX
HOLDING OVER OLGUS
OLGUS
242°
062°
MNM FL 80
MAX FL 110
230kt IAS MAX